Kingshill

POWER SUPPLIES

TECHNICAL DATA

'S & M' Series

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MP MASTER
MA23293

CIRCUIT DESCRIPTION AND OPERATING INSTRUCTIONS FOR KINGSHILL S & M SERIES STABILISED POWER SUPPLY BRICKS.

1. Circuit description.

Adjustments to suit the user's main voltage are obtained by using the appropriate tappings on the primary of the main transformer. The secondary consists of several windings which may be connected to give nominal R.M.S. outputs from 1 volt up to the maximum available in 1 volt increments. By using the lowest voltage that gives satisfactory operation for any given D.C. output, the dissipation in the unit is kept to a minimum. It is most important that attention should be paid to this point if the user decides to alter the output voltage of his units.

The main rectifier is MR2, the unregulated D.C. appearing across C2. The connection from C2 to the negative output terminal is made via the LINK on the output barrier strip; the uses to which this link may be put are described in para. 2. The connection from C2 to the positive output terminal is made via VT6, the series control element. VT6 consists of one or more power transistors in parallel, equal current sharing being ensured by emitter resistors R6. The stabilised voltage across the REF terminals is sampled by the potential divider R12, R8, RV2 and compared with the reference voltage across zener diode MR4 by the long-tailed pair VT1, VT2. Any error in the sampled voltage appears amplified at the collector of VT2 and is coupled via emitter followers VT4, VT5 and above 1 amp VT7, to the base of the series element VT6 in such a way as to reduce the error in the voltage across the reference terminals. The voltage across the reference terminals is therefore stabilised, and in 4 wire output usage (see para. 2) any voltage drop in the connecting wires between the OUT terminals and the load is absorbed by the power unit.

Protection afforded by the unit occurs in three stages.

(a) First stage constant current limiter. The voltage developed across R6 which is proportional to the load current is compared with a preset voltage across RV1. Under normal conditions the latter voltage is the greater of the two and biasses VT3 to cut-off. At a sufficiently high value of load current (determined by VR1 setting) VT3 becomes forward biassed and the drive from VT1 to VT4 is clamped to a constant value. Any attempt to increase the load current by reducing the load resistance results in a reduction of output voltage since the available load current is now fixed by VT3 action.

(b) Second stage re-entry. As the load resistance is progressively decreased the output voltage falls together with the voltage developed across VR1. This reduces the voltage required across R6 to forward bias VT3 so the load current falls to a value now determined by the voltage across VR1. When the load is a short circuit, the output voltage is zero and the voltage across VR1 is almost zero. The load current has also fallen to a value just sufficient to maintain VT3 forward biassed.

(c) Stage 3. This is independent of stages 1 and 2 being a fuse F1 which is included primarily to protect the major components from damage in the event of a catastrophic failure in any one of them.

2. Mains voltage settings.

Mains connections to all standard modules are marked at the bottom of the front panel barrier strip as L.N.E. and the primary tappings on the mains transformer must be set to correspond with the user's mains voltage. These tappings marked 10, 0, 200, 220, 240 which allow settings in 10 volt increments between 200V and 250V are connected to clearly marked turret lugs on the mains transformer panel, a soldering iron being necessary if a change is required. Mains connections to the minimodule units should be made direct to turret lugs on the transformer panel. Units are set at 240V on despatch unless otherwise specified.

3. Barrier strip connections OUT, REF, LINK.

Four-wire output is provided to allow the voltage drop in the connecting wires between the supply head and the load to be absorbed by the supply. The voltage at the load itself is thus stabilised. If this form of connection is desired, the load should be connected to the + OUT and – OUT terminals of the unit using a wire gauge sufficient to carry the load current. The wire straps between the OUT and REF terminals are then removed and a wire taken from each REF terminal to the point on the load where the stabilised voltage is required, care being taken that the + OUT and + REF wires are joined to one side of the load, and the – OUT and – REF wires to the other. The voltage at the point where the REF wires join the load will thus be stabilised.
Note. On twin units with 4" wide panels, the reference terminals are miniature sockets and the wire straps are soldered at the rear of the panel.

The wires joined to the REF terminals carry only a few mA for voltage sensing and so may be of quite light gauge. Using this form of connection the wires carrying the current from the OUT terminals to the load need not be excessively heavy to minimise the voltage drop along them.

However, in many cases two-wire output is sufficient when the user will tolerate the connecting wire voltage drop to gain the convenience of two connecting wires only. In this case + OUT and + REF terminals are linked, the – OUT and – REF terminals are linked the load is connected to + OUT and – OUT. The voltage across the terminals is now stabilised. Units are strapped for two-writing working at despatch.

The terminals mark LINK are provided for four reasons.

(a) The user may insert a remote fuse.

(b) The user may monitor current.

(c) The user may insert overload current alarm.

(d) These two terminals provide a source of constant current whose value is determined by the current in a load connected across the voltage terminals. See Para. 8.

4. Preset output voltage.

The voltage to which the unit has been preset is indicated by a stick on label on the front panel. The set volts control is mounted on this panel on the standard module, but on the mains terminal panel of the minimodule.

5. Alteration of output voltage.

The output voltage of a supply may be altered to any voltage between zero and the maximum by making at most three changes. These are :-

(a) The value of R8 to set the required voltage within the swing of the set volts control RV2.

(b) The value of R5 to set the current limiter coverage (RV1 preset)

(c) The correct mains transformer secondary tappings to suit the new output voltage. Failure to observe this requirement may result in the unit not stabilising, or its series transistors being overrun and possibly damaged.

6. Alteration of current limiter.

The current limiter is adjusted by RV1 a preset linear potentiometer which is located on the component printed circuit board of all units. The limiter may be set to operate at load currents down to about 20% of the maximum rating of the unit.

7. Mounting and ventilation.

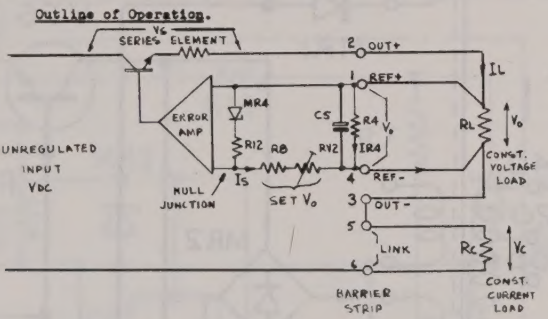
The minimodule may be mounted in any position, but standard modules are restricted to mounting positions in which the main heatsinks are in a vertical plane. The brackets supplied with each unit allow mounting to be effected from any of its faces. Adequate ventilation must be allowed, and the ambient temperature of cooling air inside the unit most not exceed that specified.

NOTE. Standard modules may be mounted with heat sinks horizontal provided that a suitable unit derating is applied. The derating will necessarily depend upon the type of unit and the circumstances in which it is used.

8. Use of S & M Series Units for Constant Current.

These stabilised power supplies have been designed for use as constant voltage and constant current supplies. To change from one mode to the other involves basically only changes in the external connections to the output barrier strip; however, in constant current use there are some load conditions that may require a certain degree of caution on the part of the user if misleading results or damage to the unit is to be avoided. These conditions are dealt with later.

Outline of Operation.



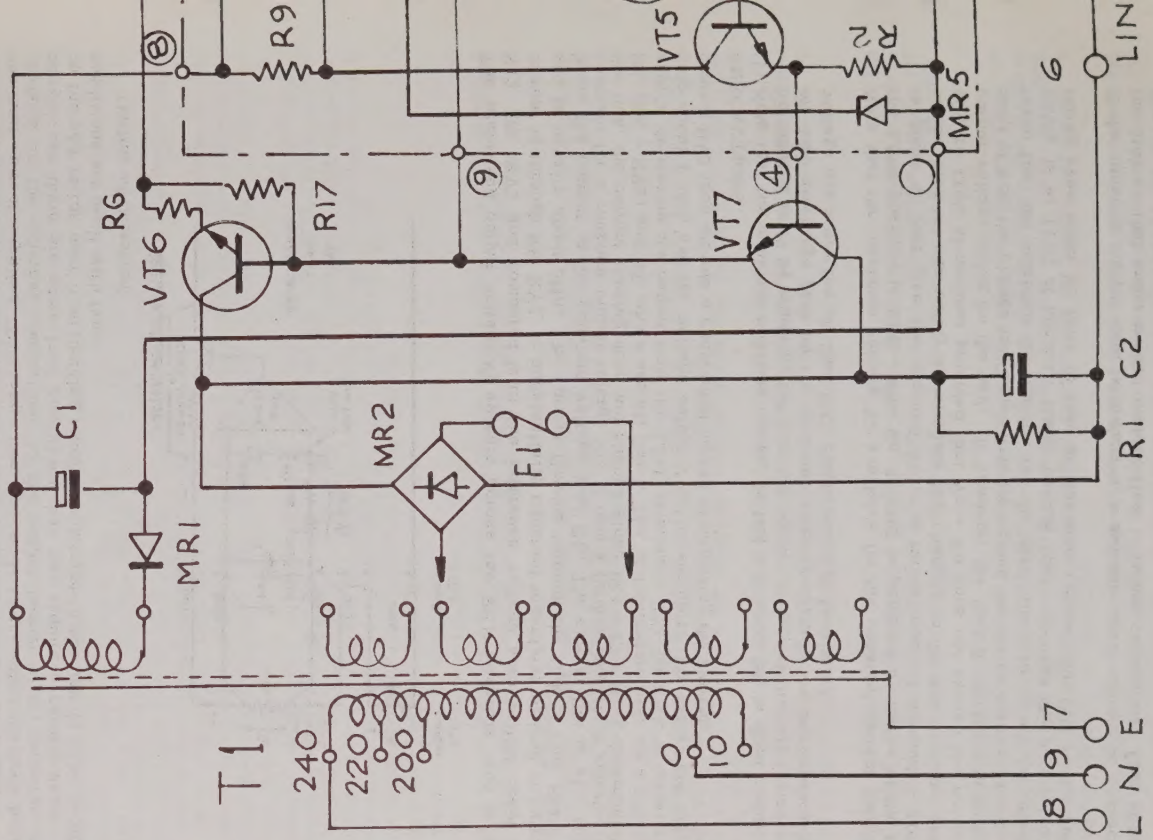
The stabilised output voltage Vo appears across the REF terminals, and is sampled by R12, R8, RV2 and compared with the reference voltage across MR4 zener mode. The current Is through R8, RV2, is substantially constant regardless of load or output voltage, and is usually about 3MA. The current flowing through the link is thus IR4 + IS+ IL, IL being the current in the constant voltage load RL. The current IR4 is also substantially constant for a constant output voltage Vo. If now a further load Rc is inserted in place of the link, the current flowing does not change since IR4 + IS + IL is determined mainly by R4, (R8 + RV2) and RL which are all fixed. The unit therefore acts as a constant current supply delivering its output from the LINK terminals. The load RL is usually chosen to drop about 1 volt, and the voltage output V out is set up to this value. The output voltage control RV2 then affords a convenient means of adjusting the current.

PRECAUTIONS.

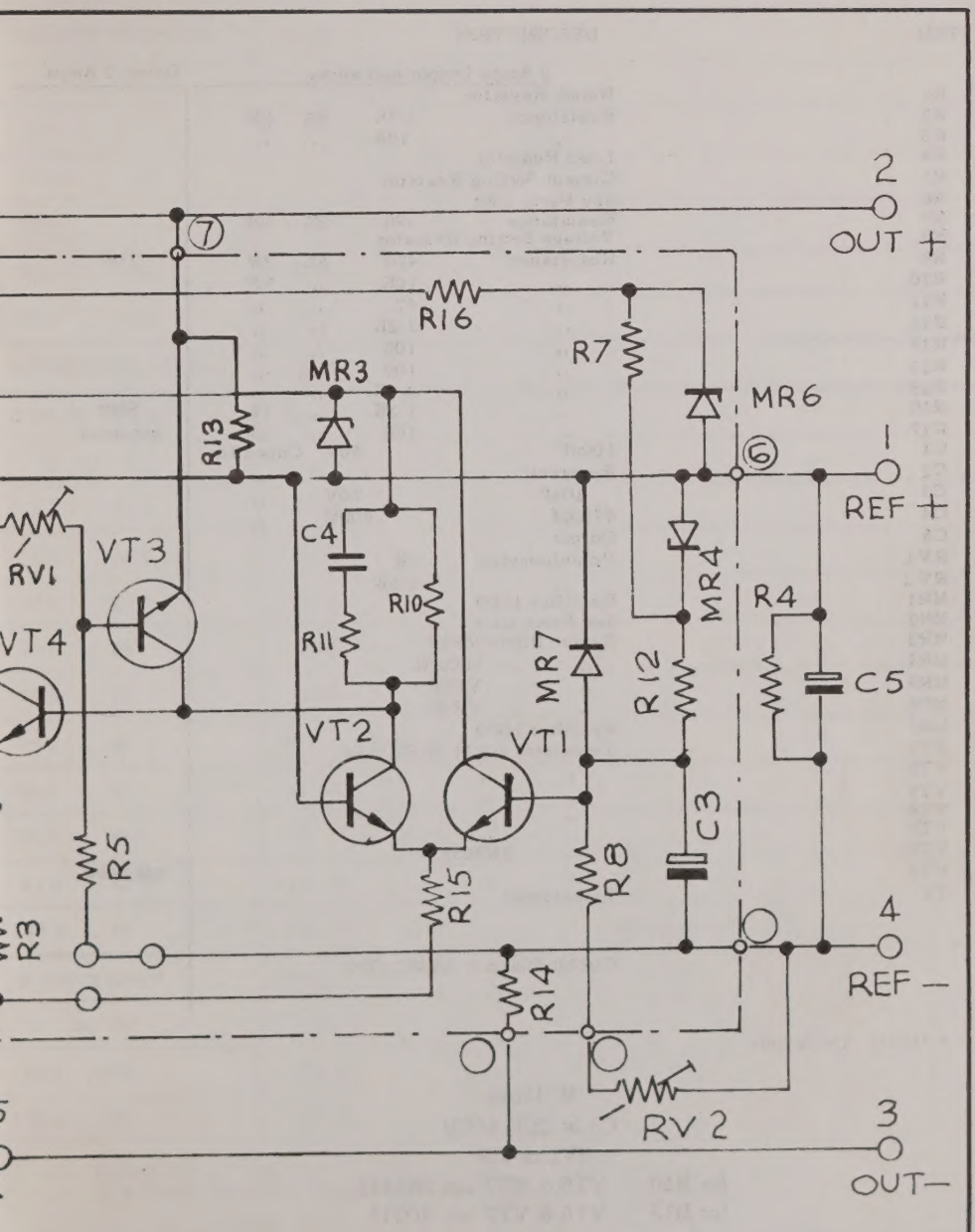
(1) Note that the minimum constant current is IR4 + IS when RL is open circuit. This may be reduced to IS by removing R4 from the barrier strip, but this also removes the main off load discharge path for C5, and may slightly degrade the performance in constant voltage use since the off load D.C. conditions will be altered.

(2) Note that the maximum voltage Vc available for the constant current load inserted in the LINK position is VDC– VS– Vo. If VDC is adjusted by means of the transformer tappings to just give the required Vc at a mains input of nominal – 10%, then the series element can safely accomodate the changes in Vs due to mains changes from 90% to 110% of nominal provided that Vc + Vo does not exceed the normal maximum output voltage rating for the unit. If however, the load Rc is reduced without adjustment of Vdc, the change in Vc also appears across the series element, and care must be taken that the maximum dissipation for the particular unit is not exceeded when the mains is at 110% of nominal. Under certain load condition the dissipation is within rating even when Vc falls to zero at maximum current, but this is not generally so.

(3) If the constant current load is inductive, a suitable diode should be connected across the link so that under normal current flow it is not conducting. This should prevent damage due to inductive surge.



ISSUE		CIRCUIT DIAGRAM
MOD		ASMIC1300


2
OUT +
⑦
R16
R7
MR3
MR6
R13
⑥
1
REF +
C4
VT3
RV1
R10
R11
MR4
R4
VT4
MR7
R12
C5
VT2
VT1
C3
R5
R8
R15
4
R3
REF −
R14
RV 2
3
OUT−

ITEM	DESCRIPTION	2 Amps Output and above	Below 2 Amps.
R1	Bleed Resistor		
R2	Resistance	3.9K 5% ½W	
R3	,,	10K ,, ,,	
R4	Load Resistor		
R5	Current Setting Resistor		
R6	See Parts List		
R7	Resistance	390 5% ½W	
R8	Voltage Setting Resistor		
R9	Resistance	470 5% 3W	270*
R10	,,	10K ,, ½W	
R11	,,	47 ,, ,,	
R12	,,	2.2K ,, ,,	
R13	,,	100 ,, ,,	
R14	,,	100 ,, ,,	
R15	,,	3.9K ,, ,,	
R16	,,	1.2K ,, 1W	820*
R17	,,	100 ,, ½W	not used
C1	100uF	50V Capacitor	
C2	Reservoir	,,	
C3	10uF	70V ,,	
C4	4700pf	400V ,,	
C5	Output		
RV1	Potentiometer	1K	
RV2	,,	2.5K	
MR1	Rectifier 10D2		
MR2	See Parts List		
MR3	Zener Diode VR9F		
MR4	,, ,, MR62H		
MR5	,, ,, VR9F		
MR6	,, ,, VR9F		
MR7	Rectifier 10D2		
VT1	Transistor 40231 or BC108b		
VT2	,, ,, ,,		
VT3	,, ,, ,,		
VT4	,, ,, ,,		
VT5	,, ,,		
VT6	,, 2N3055		
VT7	,, ,,		not used
T1	Transformer		
	Circuit Diagram AMMIC1300		

* "Mini" Units only.

'M' Units

C3 is 2UF 150V

RV2 is 25k

for M10 VT6 & VT7 are 2N3442

for M15 VT6 & VT7 are 40313

THE COMPANY RESERVES THE RIGHT TO AMEND SPECIFICATIONS WITHOUT PRIOR NOTICE.

SETTING – UP VALUES OF RESISTANCE FOR S & M SERIES

OUTPUT VOLTAGE	R5
2 to 6	2.2K
6.1 ,, 15	5.6K
15.1 ,, 30	15 K
30.1 ,, 60	27 K
60.1 ,, 120	56 K
120.1 ,, 240	100 K
CONSTANT CURRENT	8.2K
S UNITS ONLY	R8
0 to 6	0
6.1 ,, 11.5	1.8K
11.6 ,, 16.5	3.9K
16.6 ,, 20	5.6K
20.1 ,, 24	6.8K
24.1 ,, 28	8.2K
28.1 ,, 33	10 K Selected
33.1 ,, 38	12 K ,,
38.1 ,, 41.5	13 K ,,
41.6 ,, 46.5	15 K ,,
46.6 ,, 49	16 K ,, 18K above 49V
M UNITS ONLY	R8
0 to 50	0
50.1 ,, 100	18 K
100.1 ,, 150	39 K

GUIDE TO A.C. INPUT FOR D.C. OUTPUT
(A.C. MAY REQUIRE FINAL ADJUSTMENT TO MEET SPEC.)

$V_t = 0.9V_o + 5$

V_t = A.C. Secondary Volts on transformer

V_o = D.C. Output Volts.

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